

Work Plan For:

An Enhanced Immiscible Product Recovery System

For:
The L.E. Carpenter & Co. Facility
Wharton, New Jersey

18 January 1991



WSI® *Weston Services, Inc.*



**ENHANCED IMMISCIBLE PRODUCT RECOVERY SYSTEM WORK PLAN
L.E. CARPENTER & CO.**

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SECTION 1

BACKGROUND

1.1 PROJECT DESCRIPTION AND OBJECTIVES

This Enhanced Immiscible Product Recovery System (EIPRS) work plan presents the Development of Alternatives and the Conceptual Design for a program to enhance the collection of immiscible product floating on the water table beneath part of the L.E. Carpenter & Co., Inc. facility in Wharton, New Jersey. Since May 1984, L.E. Carpenter has been operating an immiscible product recovery system using two or more monitoring wells east of the tank farm area. The proposed existing system modifications and alternatives presented in this work plan are intended to enhance the collection of the immiscible product operable unit.

At the time of this report, L.E. Carpenter is also preparing a Feasibility Study (FS) in accordance with the EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (1988). The recommended alternative developed in the EIPRS work plan will be incorporated in the FS for the immiscible product operable unit.

L.E. Carpenter's intent is to implement the EIPRS as soon as possible before the FS and Record of Decision have been finalized. With this focus in mind, L.E. Carpenter has chosen, with the concurrence of the New Jersey Department of Environmental Protection (NJDEP), to consider EIPRS alternatives which can be implemented in a short time frame (reference letter from Edgar Kaup, NJDEP, dated November 9, 1990). Therefore, the EIPRS alternatives are based on conventional and available technology and are essentially constrained in terms of their short-term implementation to what is referred to in this report as passive recovery options.

Passive immiscible product recovery systems involve the collection or skimming (via pumps) of the immiscible product with only incidental collection of groundwater. The recovery rate of passive recovery systems declines over time the soil near the collection point is depleted of product. Active recovery involves depression of the water table via pumping the groundwater below the immiscible product layer in order to increase the gradient of immiscible product toward the collection point(s). This gently increases the rate of immiscible product collection. However, because the pumped groundwater contains dissolved contaminants, discharge to surface water, groundwater, or a POTW (even after treatment at the site) would require a New Jersey Pollutant Discharge Elimination System (NJPDES) permit. This permitting process would take 8 to 36 months. Although disposal of the pumped groundwater to an off-site TSD facility would enable the implementation of an active recovery system without obtaining a discharge permit, the cost associated with the large volume of groundwater effectively eliminates off-site disposal as a viable option for immiscible product operable unit. Groundwater collection and treatment is being evaluated as part of the ongoing FS.

Although the EIPRS will be implemented initially as a passive recovery system, consideration has been given in the evaluation of EIPRS alternatives to their long-range applicability, such as later conversion to active recovery in the final site remediation.

1.2 BACKGROUND INFORMATION

In January 1982, L.E. Carpenter and the NJDEP entered into an Administrative Consent Order (ACO) to remediate site contamination. On September 26, 1986, an amended ACO was agreed upon required specific action at the site. The site was identified on the National Priorities List (NPL) in July 1987. Currently, portions of the site are rented to several tenant businesses.

The L.E. Carpenter site occupies approximately 14.6 acres in an industrial/residential area of Wharton, New Jersey, as shown in Figure 1-1. The site is bounded on the south by the

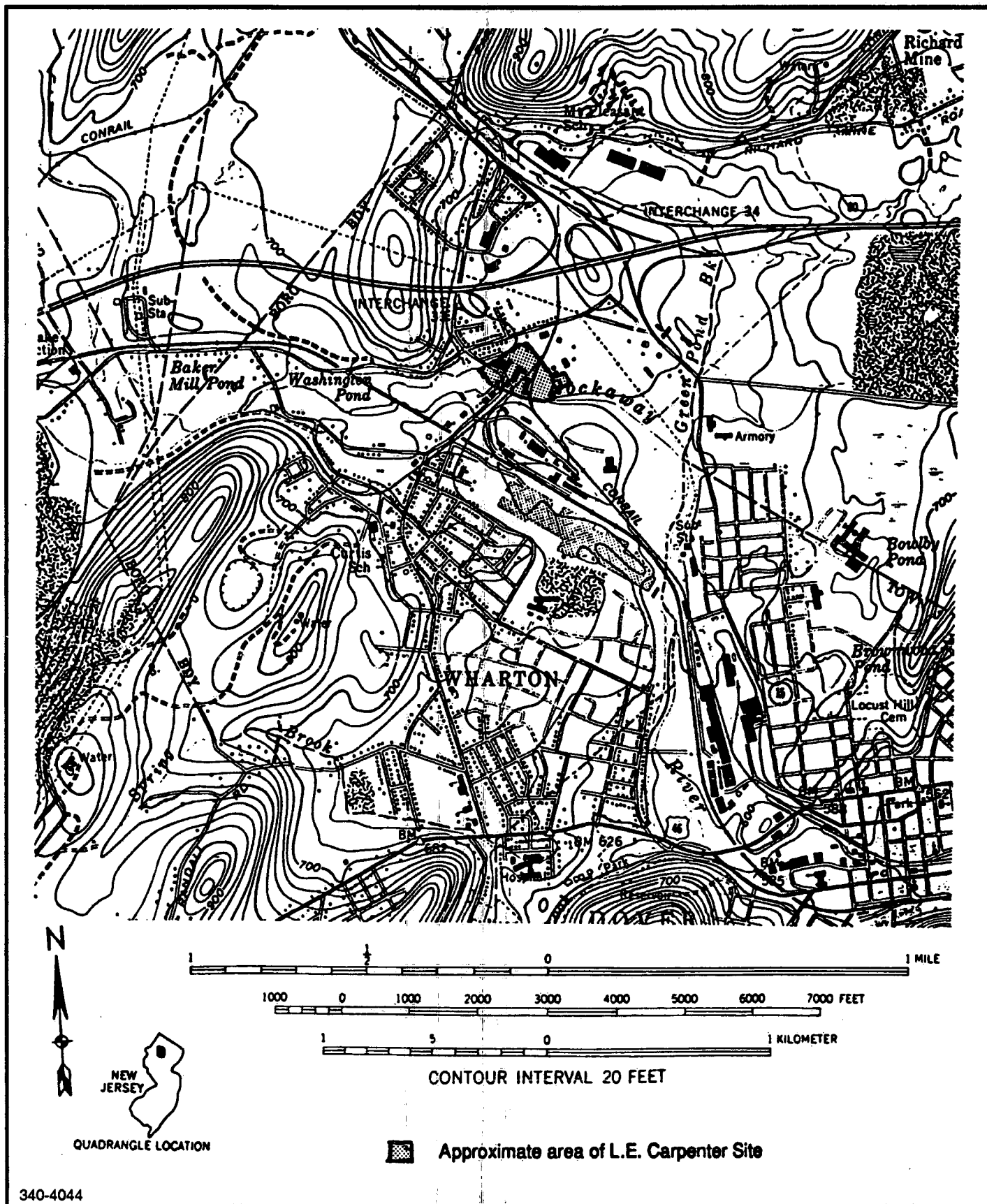


FIGURE 1-1 SITE LOCATION AND TOPOGRAPHIC MAP

Rockaway River, on the east by a vacant lot owned by Wharton Enterprises, on the northeast by a compressed gas facility (Air Products, Inc.), on the northwest by Ross Street and a residential area, and on the west by Washington Forge Pond as shown in Figure 1-2. A drainage ditch (along the northern site boundary) drains a portion of the site and the Air Products property, and eventually discharges to the Rockaway River downstream of the site. The site is divided in half by inactive railroad tracks of the Mount Hope Mineral Railroad. Most of the site west of the tracks falls within the 100-year flood plain. The site is bordered by a security fence along North Main and Ross Streets, which separates it from the Air Products property. Construction of additional fencing to restrict access to the areas of the site west of the railroad tracks and around the former starch drying beds is planned for the first quarter of 1991.

The L.E. Carpenter property lies along the north bank of the Rockaway River. The average topographic slope of the site is approximately 1.2 percent in an easterly direction towards the drainage ditch. However, the bedrock surface underlying the site forms a valley-like trough. The axis of this bedrock valley trends approximately east-southeast. The observed depth below ground surface to bedrock ranges from 165 feet at monitoring well MW-11d near the former impoundment area to 46 feet at monitoring well MW-17d near the river. The bedrock is described as medium- to coarse-grained granite that exhibits some horizontal to near-vertical fractures.

The overlying unconsolidated sediment was deposited in a glaciofluvial and recent fluvial (e.g., flood plain) environment. The overburden is composed primarily of fairly uniform medium-to-coarse grained sand and fine-to-medium grained gravel. The soil near the surface contains a wider range of grain sizes from silt to boulders. A typical soil description is dark brown, fine-to-coarse grained sand, some fine-to-medium grained gravel, little silt, frequent cobbles and boulders. At some locations, near surface materials consist of fill that includes cinders, fly ash, gravel, asphalt, concrete, debris, and tailings from former mines in the area.

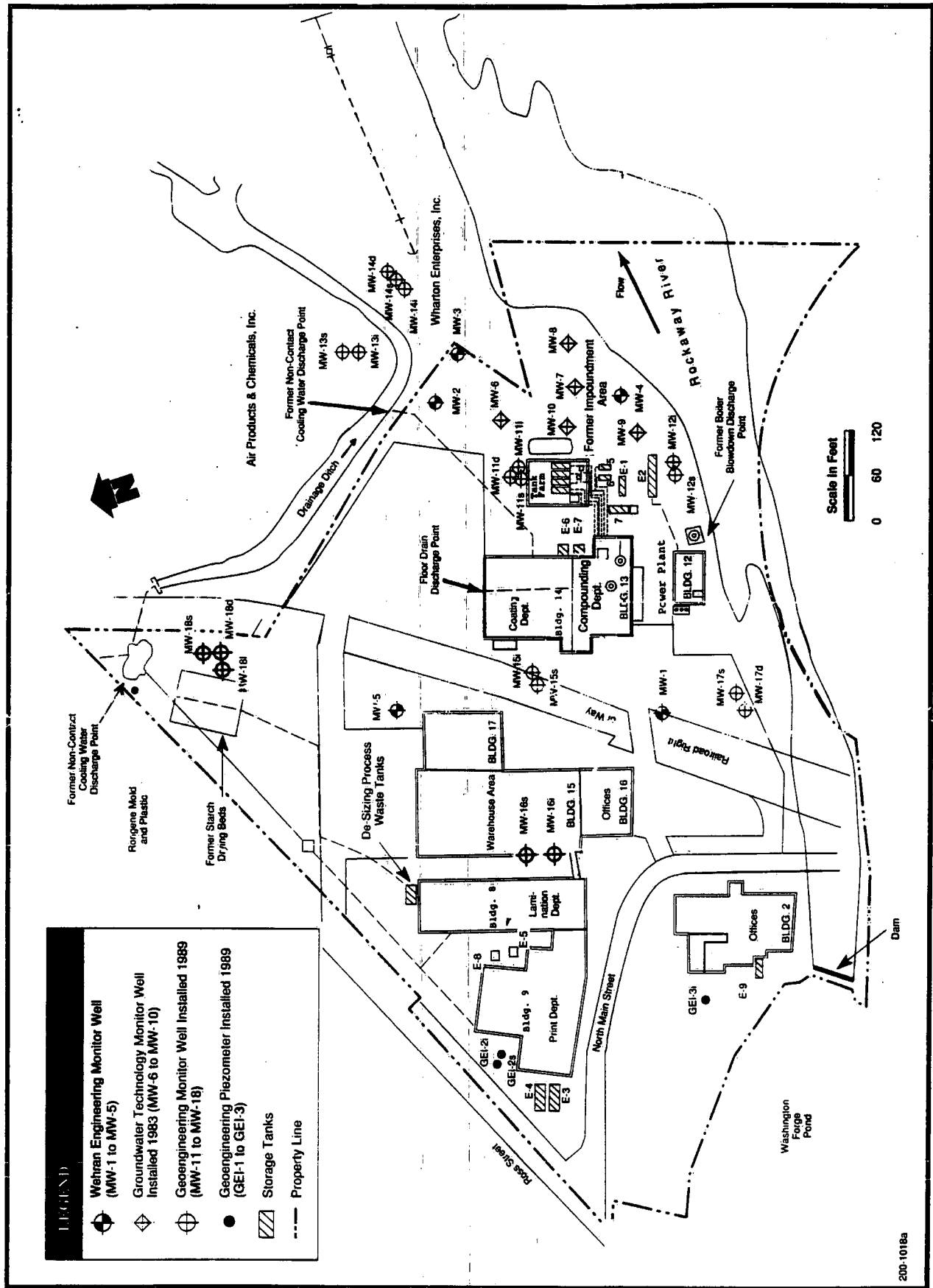


FIGURE 1-2 L.E. CARPENTER AND COMPANY SITE PLAN

Slug testing of on-site monitoring wells has shown that the unconsolidated deposits on-site have a high permeability. The average hydraulic conductivity in the intermediate and deep zones of the saturated, unconsolidated deposits is 1.8×10^{-2} cm/sec. Based on hydraulic head data from on-site monitoring wells screened in the unconsolidated deposits, the water table at the site is generally 3 to 12 feet below the ground surface and groundwater flows to the east-northeast with a gradient of 0.003 ft/ft across the site. There is evidence that some of the shallow groundwater from the site and the majority of the surface water runoff discharges to the drainage ditch.

Groundwater in the vicinity of the site is not heavily used. A search performed by WESTON of well permits on file with NJDEP has tentatively identified two domestic wells and one irrigation well within 2,000 ft of the site boundary. It is not known if these wells are still in use. The depths of these wells ranged from 88 to 120 ft. Trichloroethylene (TCE) has been detected in two inactive public supply wells located 4,000 feet to the west (upgradient). During the L.E. Carpenter Remedial Investigation (RI), TCE was also detected in monitoring well MW-13s, located offsite to the north, at a concentration of 5 ppb. However, TCE has not been detected in any of the 27 monitoring wells on the L.E. Carpenter site.

In addition to the ongoing immiscible product collection, several site clean-up activities have already been implemented. In 1982, L.E. Carpenter removed 3,500 cubic yards of sludge and soil from the former onsite surface impoundment. All raw materials have been removed from the site and asbestos removal has been conducted in Buildings 12 and 13. The contents of the above and below-ground storage tanks have been cleaned in place. Removal of all tanks at the site is planned for the first quarter of 1991 pending NJDEP approval of the tank closure plan.

SECTION 2

CURRENT SITE CONDITIONS

2.1 CURRENT IMMISCIBLE PRODUCT CONDITIONS

2.1.1 Immiscible Product Characterization

The immiscible product layer at the L.E. Carpenter site has been identified as a mixture of hydrocarbons identified as or similar to bis(2-ethylhexyl)phthalate (DEHP), lubricating oil, naphtha, and gasoline (including xylene, ethylbenzene, and unknown hydrocarbons). Previously, the immiscible product had been characterized in the RI as primarily xylene, which is now believed to be only a secondary component of the hydrocarbon mixture. The previous characterization is believed to have been based largely on an analysis of an immiscible product sample collected by U.S. EPA and on other undocumented characterizations of the recovered immiscible product. The analyses of the immiscible product performed by EPA in 1975 is described in Appendix F of the ECRA Site Evaluation Submission (SES, 1987) as "a mixture of aromatic hydrocarbon blends and high boiling phthalate esters; mostly xylene with small amounts of toluene and C-3 substituted alkyl benzenes".

The 1975 characterization of the immiscible product layer by EPA was based on the site conditions and analytical procedures available at that time. The methods used to sample and analyze the 1975 sample may have produced inaccurate results. Another possible explanation for the apparent decrease in xylene is that the xylene was originally present as the top strata of an immiscible product layer because of its lower specific gravity (0.86 vs. 0.99 for DEHP) and has been preferentially skimmed off. The apparent reduction in xylene may also have been influenced by volatilization and biodegradation.

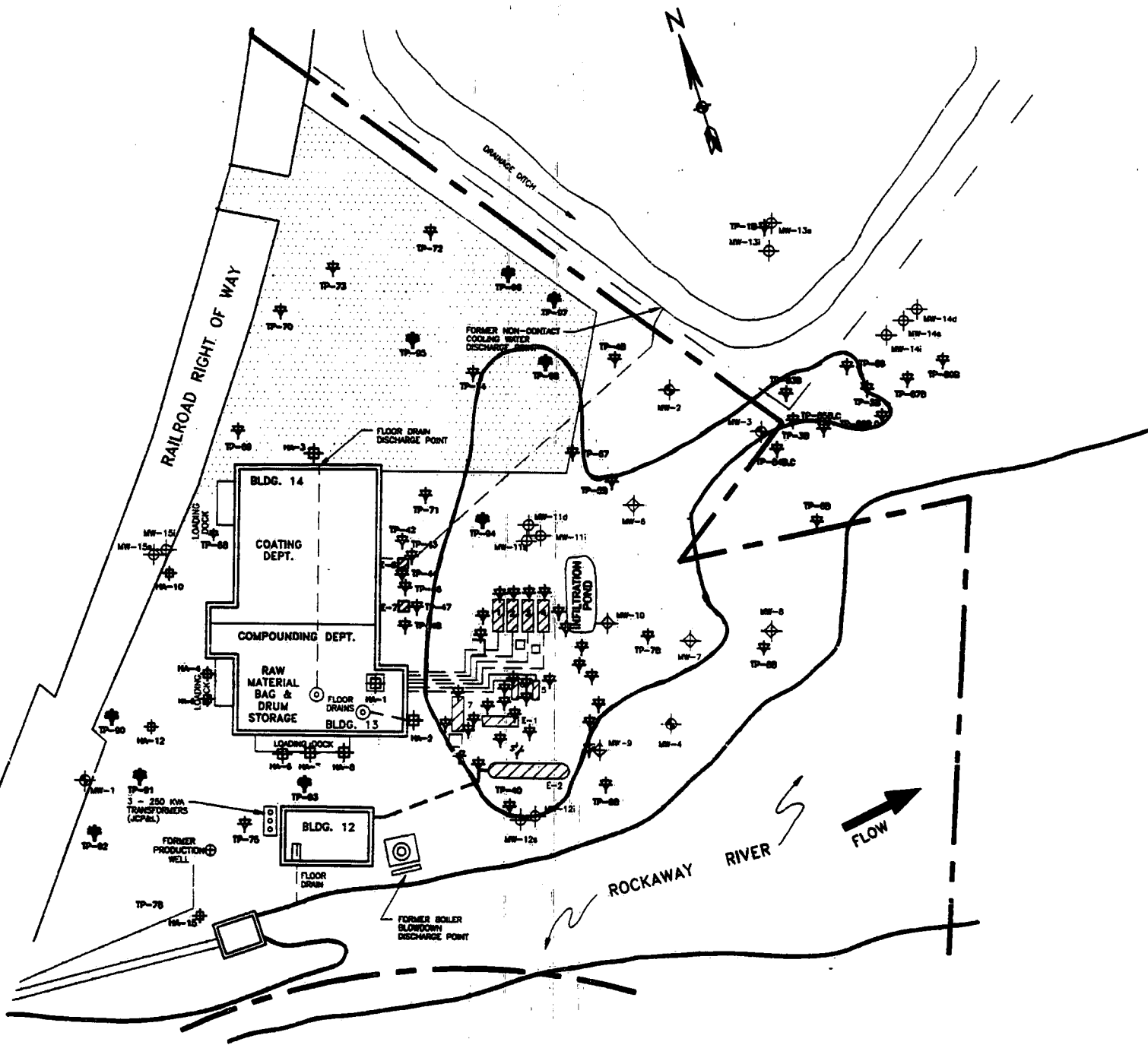
The current characterization of the immiscible product is based on gas chromatograph fingerprint analyses and a gas chromatograph/mass spectrometer analysis of one immiscible

product sample collected and analyzed by WESTON Analytics as part of the EIPRS design effort. This sample was collected from MW-11s on 18 December 1990 using a 2-inch bailer. A sample of the immiscible product in MW-11s was also collected and analyzed during both of the groundwater sampling rounds conducted for the RI. These results were included in the analytical data package delivered to NJDEP but were not discussed in the original RI report. The results of the analyses of these three samples are provided in Appendix A.

2.1.2 Extent of Immiscible Product

Figure 2-1 shows the current estimate of the approximate extent of immiscible product in the subsurface at the L.E. Carpenter facility. Available data indicate that the immiscible product is thickest in the vicinity of monitoring well MW-11s. This estimate is based on monthly measurements of immiscible product in monitoring wells and to a lesser extent on analytical results and HNu photoionization detector readings from test pits completed during the RI and Supplemental RI programs. In addition, nine additional exploration test pits were completed in December 1990 as a part of the EIPRS effort in an attempt to better define the extent of immiscible product in the vicinity of MW-1 and test pits TP-74 and TP-4A. Because of the limited reach of the backhoe available for test pit excavation, the depth of test pits was constrained to a maximum of 6 to 8 feet.

These test pits, excavated by WESTON on 14 and 17 December 1990, and identified as TP-90 through TP-98, were observed visually for evidence of immiscible product (an oil sheen) and were scanned with an HNu but were not sampled for laboratory analysis. Test pits TP-90, TP-91 and TP-92, shown in Figure 2-1, were completed to a depth of 6 feet in the vicinity of MW-1. No evidence of immiscible product such as odors, HNu readings or liquids were observed. However, since the water table in the vicinity of MW-1 is about 12 feet below ground surface, these exploratory test pits would not have been deep enough to encounter any immiscible product.



LEGEND

- — — — — PROPERTY LINE
- - - - - UNDERGROUND PIPING
- - - - - FENCE
- ▨ STORAGE TANKS
- ▤ PAVED AREA

- ⊕ HAND AUGER SAMPLE LOCATION
- ⊕ TEST PIT LOCATION
- ⊕ EPRS EXPLORATORY TEST PITS
- ⊕ WEDRAN ENGINEERING MONITOR WELL INSTALLED 1980 (MW-1 TO MW-5)
- ⊕ GROUNDWATER TECHNOLOGY MONITOR WELL INSTALLED 1983 (MW-6 TO MW-10)
- ⊕ GEOENGINEERING MONITOR WELL INSTALLED 1989 (MW-11 TO MW-18)



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EXTENT OF IMMISCIBLE PRODUCT

FIGURE	DATE	REVISION
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Test pit TP-93 was excavated to a depth of 6 feet in the area between Building 12 and 13. This test pit was excavated to investigate the possibility that the immiscible product observed in MW-1 is continuous with the immiscible product observed in MW-12s and MW-11s. Although no evidence of immiscible product was observed in test pit TP-93, the water table was not reached.

Test pit TP-94 was excavated to a depth of about 8 feet adjacent to MW-11s where immiscible product has been observed. Evidence of immiscible product was observed in this test pit. Test pits TP-95, TP-96, TP-97 and TP-98 were excavated to evaluate the extent of immiscible product beneath the parking lot north of Building 14. The water table was reached in all these test pits but evidence of immiscible product was observed only in test pit TP-98.

Potential sources of immiscible product are discussed in the RI Report and in Appendix F of the SES.

2.2 EXISTING RECOVERY WELL SYSTEM

Remediation of the immiscible product layer at the site has been ongoing since May 1984. As of January 1991, over 4,700 gallons of immiscible product have been collected. The original immiscible product recovery system consisted of an electromechanical "Auto-skimmer" apparatus manufactured by R.E. Wright, Inc. Every two or three weeks, depending on system performance, the skimmer was moved between monitoring wells MW-6, MW-7 and MW-10 after the immiscible product had been removed to the extent possible from the previous well. Over the lifetime of this system, the thickness of immiscible product at monitoring well MW-7 was reduced from its original thickness (a maximum of 5.18 feet) to a level at which it is no longer recoverable. (With the exception of the May and June 1990 level readings, less than 0.1 inches of immiscible product have been present in this well during the past year).

In September 1989, the original recovery system was replaced with a specific gravity-type skimmer system to improve the operational reliability and accelerate the recovery of immiscible product. The current recovery system, installed in monitoring wells MW-10 and MW-11s, skims immiscible product at an effective rate of 1.3 gallons per day.

The existing recovery equipment is an SOS system manufactured by Clean Environment Engineers, Inc. The primary components of the system include two in-well skimmer assemblies, a pneumatic controller, an air-operated double-diaphragm immiscible product pump, an air compressor, and a immiscible product collection drum. The immiscible product intake, because of its specific gravity, floats on the water level surface in the well. The pump is time-activated so that any immiscible product above the skimming intake is withdrawn at regular intervals. The interval for the L.E. Carpenter system has typically been set at 40 seconds of pumping every 2 minutes. The effective yield of any immiscible product recovery system is determined not by the timer intervals but by the rate at which immiscible product is released from the soil and flows into the wells.

The entire SOS system, with the exception of the in-well skimmer assemblies, is housed in a shed adjacent to monitoring well MW-10. Currently, the skimmers in monitoring wells MW-10 and MW-11s are connected to separate halves of the same double-diaphragm pump via a 1/4-inch steel-sheathed hydraulic hose run below ground through a 3-inch PVC conduit. These skimmers can effectively collect a floating layer down to a thickness of approximately 1-inch. The position of the skimmer, which is suspended from the well casing by a cord, can be easily adjusted. The vertical range (travel) of the floating skimmer intake is limited to 12 inches. To prevent the skimmer intake from being submerged in water above the upward limit of its travel, the skimmer assembly in monitoring well MW-10 is equipped with a bubbler-type pressure sensor which shuts-off immiscible product pumping when the total liquid level in the well rises approximately 11 inches above the base of the skimmer's travel. Independently, a high-level in the recovery drum, caused by a full drum or crimped/disconnected sensor hose, also shuts-off immiscible product pumping.

While the mechanical reliability of the SOS system has generally been good (with the exception of frozen immiscible product lines during December 1989 and a loss of electrical power during December 1990), its effectiveness has been limited by constraints caused by the control system and hydrogeologic conditions at the site. As previously mentioned, the skimmers in both monitoring wells MW-10 and MW-11s are shut down by a high water level in monitoring well MW-10. However, water elevations at the site have been observed to fluctuate over a range of 2.5 feet or more based on the monthly water level data for the period October 1989 through October 1990. This large variability is attributable to the hydrogeology at the site caused by the combined influence of the Rockaway River (which is prone to rapid increases in elevation after precipitation events), the dammed Washington Forge Pond, the Air Products drainage ditch, and highly permeable soils.

For the area of the Wharton Enterprises property near monitoring well MW-14s, the fluctuations are slightly less, approximately 1.5 feet. For areas close to the Rockaway River (i.e., monitoring well MW-9), the range of water table fluctuations was observed to be as large as 4 feet based on monthly water level readings during 1989-1990.

Based on the limited data available, fluctuations in the water table appear to be rapid changes in response to precipitation events rather than gradual seasonal changes. For example, the water level elevation in monitoring well MW-8 rose 2.3 feet between January 5, 1990 and January 26 and dropped 1.6 feet between January 26 and February 5.

The restricted travel range of the existing SOS equipment limits system operation to within an 11-inch range of water table fluctuation. Even if the skimmer is set at the optimal height in each well, this constrained travel reduces the operating time of the system by approximately one third (based on monthly water level data from 1989-1990).

The problem caused by the wide variability in water table elevation is compounded by additional changes in water levels in the recovery wells caused by changes in the thickness of the immiscible product layer. As discussed previously, the immiscible product layer inside

monitoring well MW-11s has been as thick as 8 feet, which is several times its thickness in the surrounding soil. The immiscible product displaces the water level in the well by an amount almost as great as its own thickness. When immiscible product thicknesses increase, which can be caused by a shutdown of the recovery system or by the hysteretical effect of a receding water table¹, the water elevations in wells with immiscible product drop sharply. Because each well accumulates immiscible product at a different rate, the effective fluctuation of the water level differs between wells. These relative changes between wells make the underlying hydrogeology more difficult to characterize and the optimum skimmer settings more difficult to determine, especially when modifications are made only once per week.

Because of the wide variation in the water table and the relative variability caused by differences between wells (i.e., monitoring well MW-11s accumulates immiscible product at a faster rate than monitoring well MW-10) the skimmers have been set higher in the well than optimum in order to avoid frequent high level shutdowns and the possibility of collecting water instead of immiscible product while the skimmer is caught below the water elevation at the top of its travel. This explains why, despite the skimmers capability to recover immiscible product down to a thickness of 1 inch, several feet of immiscible product have often been present in the recovery wells. This problem has also, at times, caused the skimmers to collect water, particularly in monitoring well MW-11s. The difficulty of adapting the existing system to the changes in the water table is also a primary reason why monitoring well MW-6 has not been used as a recovery well (except to be manually bailed free of immiscible product once a month) since monitoring well MW-11s was added to the

¹The hysteretical effect, which is discussed in "Estimation of Free Hydrocarbon Volume from Fluid Levels in Monitoring Wells" in the January 1990 Groundwater, refers to the phenomena whereby immiscible product becomes trapped within the continuous water phase during periods of rising water tables. During periods of falling water tables trapped immiscible product becomes remobilized leading to increases in monitoring well product thickness measurements.

system. Coordinating and optimizing three skimmers with the limited 12-inch travel would be difficult.

The thickness of the immiscible layer present in the recovery wells has further diminished the effective recovery rate during the past year. If immiscible product thickness in the wells is maintained at the minimum attainable thickness, the gradient between the level of the immiscible product in the surrounding soil and the level in the well is maximized. While this effect is difficult to quantify, the depth of immiscible product in monitoring wells MW-10 and MW-11s during 1989-1990 appears to be approaching the equilibrium level at which net flow of immiscible product into the well is zero.

Other factors which have contributed to less than optimal recoveries from the existing system during 1989-1990 include: 1) the difficulty and cost of modifying the SOS system's pneumatic controls; 2) the limited product collection tank volume (a 55-gallon drum); 3) manpower requirements for system optimization and maintenance; and 4) start-up difficulties.

2.3 PASSIVE RECOVERY RATE POTENTIAL

To estimate the passive recovery potential from existing wells, a rough measurement of immiscible product influx into monitoring well MW-11s was made by WESTON on 18 December 1990. The immiscible product layer in monitoring well MW-11s, which was initially 5.98 feet (the SOS was shutdown due to a loss of electrical power at the time), was bailed out to maximize the gradient for influx of floating immiscible product. Measurements of the immiscible product thickness were taken at 20, 30, 40, 50, and 60 minutes after the initial removal of the immiscible layer. Because readings from a Solinst model 121 interface meter were found to be erratic, the thickness measurements were made by measuring the level of the immiscible product withdrawn in a translucent teflon bailer. Based on the first one hour, the initial recovery rate for monitoring well MW-11s was estimated to be 5.8 gallons per day. During the 48 hours after the start of the trial, the average recovery rate

was estimated to be 0.7 gallons per day. Both estimates are upwardly biased because some of the inflow during the trial was residual product present in the gravel pack of the well annulus which would not normally be present at equilibrium conditions. The trial estimates are also upwardly biased by the fact that MW-11s has the greatest amount of immiscible product present of any well at the site. Based on this trial the maximum recovery rate for MW-11s is believed to be in the range of 0.7-3 gallons per day. This rough estimate of immiscible product influx provides the basis for an upper bounds on the initial recovery potential for improvements to the existing system as well as alternatives which would provide additional product collection points.

SECTION 3

DEVELOPMENT OF ALTERNATIVES

Four primary alternatives for the EIPRS are developed in this section:

- Improvements to the Existing System
- Additional Recovery Wells
- Caisson Sumps
- Recovery Trenches

3.1 IMPROVEMENT TO THE EXISTING RECOVERY SYSTEM

The primary opportunity for improving the performance (defined as the average recovery rate of water-free immiscible product) of the existing recovery system lies in utilizing MW-6 for recovery and in adapting the system to amount of water table fluctuation observed at the site. To accomplish this, it is proposed that the existing down-well skimmer assemblies be replaced with another model by the same manufacturer. This modification will enable the skimmer to operate over a 48-inch range of water level fluctuation in the well as opposed to the current 12-inch range.

By increasing the effective operating range of the skimmers, the actual operating time of the skimmers may be increased by approximately 50%. This estimate is based on the previously cited monthly water level data from 1989-1990 which indicates that the water table elevation falls outside of an optimally selected 11-inch range during roughly one-third of the observations.

Increasing the skimmer's travel will enable the skimmers to be positioned low enough in the well to collect immiscible product to their minimum recoverable product thickness without becoming submerged in water at the upper limit of their travel.

The proposed improvements to the existing system will utilize a combination of two types of SOS skimmer: two SPG-4 TID (on MW-10 and MW-11s) and an SEL-4 TID (on MW-6). Both types will have the extended travel as well as a maximum immiscible product pumping capacity (based on their larger diameter) which is three times that of the existing equipment. The SEL-4 skimmer, which operates on the basis of an oleophilic membrane rather than the specific gravity of a skimming intake, are able to skim immiscible product down to a sheen. For this reason, the SEL-4 skimmer is proposed for MW-6, which has the thinnest product layer of the three wells. This skimmer could also be moved to another well when no recoverable product remains at MW-6. The SPG-4 TID skimmers, which are essentially a larger, extended-travel version of the existing equipment, are limited to a minimum recovery thickness of approximately 1-inch. Compared to the SEL-4, the SPG-4 offers the benefits of low maintenance, greater water-exclusion reliability, and easier convertability to future active recovery.

The SPG-4 skimmer is readily convertible to active product recovery with groundwater depression once all necessary groundwater treatment facilities and discharge permits are in place. Such a conversion would involve the installation of pneumatic level sensing and water discharge lines (through the existing buried conduit), the installation of double-diaphragm groundwater depression pump, and the addition of module to the SOS pneumatic controller. The SPG-4 units are readily adaptable to groundwater extraction rates of up to 15 gallons per minute. This pumping rate would dramatically increase the recovery rate of floating product but would likely provide only a fraction of the total groundwater extraction, flowrate typically used during a full scale groundwater remediation.

The advantages of this alternative are that the improvements would be rather easily implemented. The disadvantage is that areas with product not within the radius of influence of the wells (e.g., near MW-1) would not be impacted.

Based on the MW-11s trial, the initial recovery rate for this alternative is estimated to be 2-4 gallons per day.

A related alternative which was considered but not developed was the use of additional existing wells for recovery purposes. Product is frequently observed in MW-1, MW-3, and MW-12s. The installation of skimmers in these wells was rejected for the following reasons:

- Although MW-1 and MW-3 are in locations suitable for product recovery, their diameter is only 2-inches. Passive product recovery using a 2-inch well is feasible but slow. Skimmers capable of collecting product down to a sheen require at least 4-inches. Similarly, groundwater depression can be conducted in a 2-inch well but is constrained to a maximum of 10 gpm.
- MW-1 and MW-3 are sampled quarterly. Installation of skimmers would disrupt the monitoring data and would require the removal of the GEOMON samplers.
- Because MW-1 and MW-3 are carbon steel wells installed in 1980, their remaining useful life may be limited.
- The floating product in MW-12s is believed to be related to the No. 6 fuel oil formerly stored in tanks E-1 and E-2. Because of the high viscosity of No. 6 fuel oil, migration to a collection point would be slow. In addition, few commercially available skimming systems are capable of pumping a product of this viscous.

3.2 ADDITIONAL RECOVERY WELL ALTERNATIVE

This alternative involves increasing the total product recovery rate via the installation of new recovery wells and skimming equipment.

The use of additional recovery wells offers the following advantages:

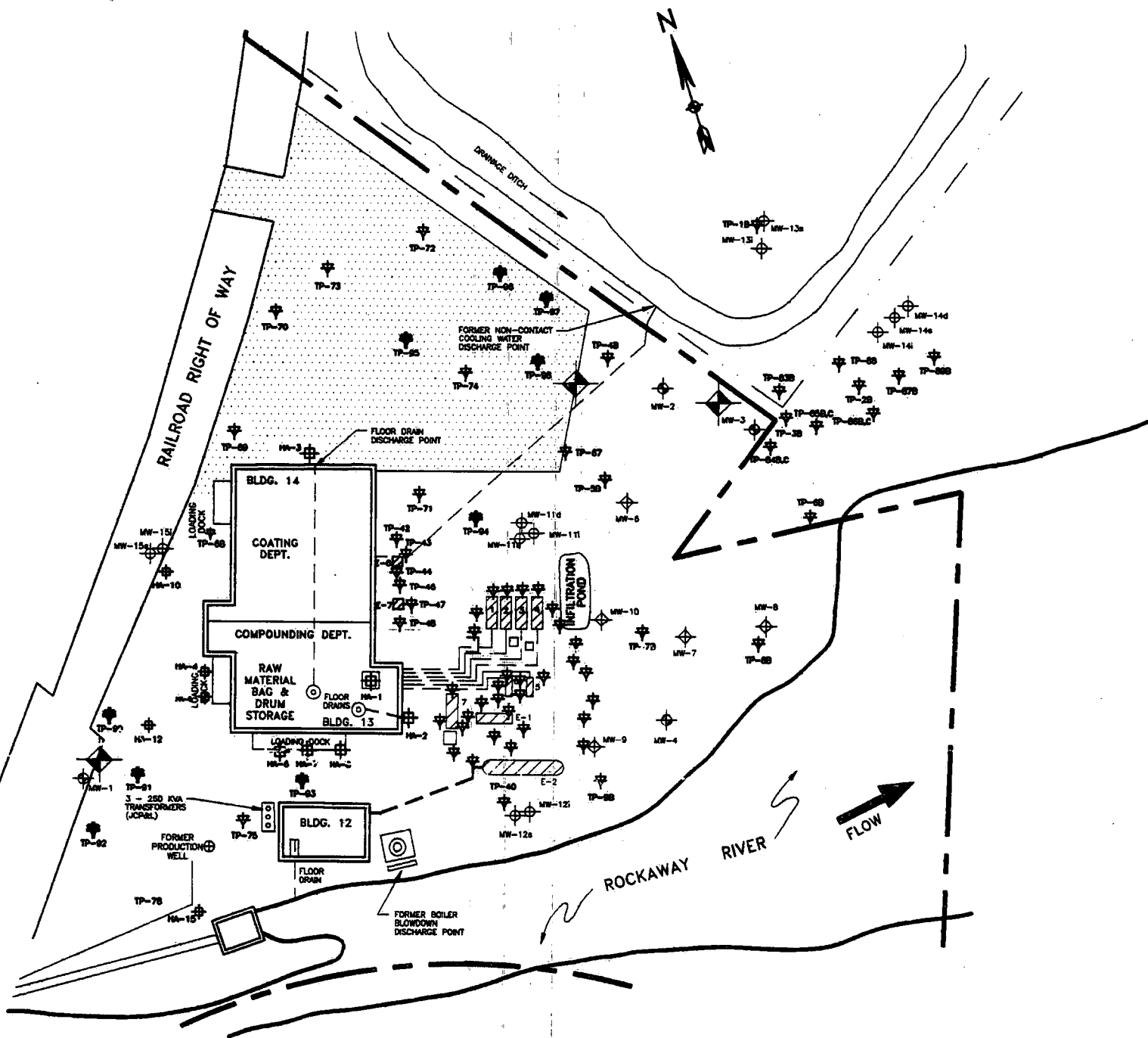
- Proven technology with wide selection of skimming equipment available.

- Such wells might be converted to groundwater extraction as part of a long-term remedial design involving treatment of shallow groundwater and/or active recovery of immiscible product.
- Capability to expand on the existing SOS recovery system.
- Provides additional groundwater monitoring points in the shallow hydrogeologic zone.
- Minimal excavation of soil requiring disposal.

Based on the extent of the immiscible product layer and on the location of the existing recovery wells for this alternative are located at the three points shown on Figure 3-1. The rationale for locating a well near both MW-2 and MW-3 is to enable the collection of the immiscible product downgradient of the existing wells. The available monthly product thickness data indicate that wells located further downgradient are not likely to consistently have a recoverable product thickness (i.e., greater than 2-inches).

A third recovery well would be located immediately downgradient of MW-1. This recovery point has been located close to MW-1 rather than a location further downgradient to maximize the probability of encountering a recoverable product thickness, since the extent of product in this area has not been determined.

The location of these three recovery points drives the selection of skimming equipment for this alternative. The additional well near MW-1 could not be added to the existing SOS system which is limited to a maximum product line distance of 250 feet. Any skimming equipment in the area of MW-1 would need to be a stand-alone, electrically powered system. The skimmer best suited to this application is the 6-inch Filter Scavenger unit manufactured by ORS Environmental Equipment. The advantages of this unit are its



LEGEND

- PROPERTY LINE
- - - UNDERGROUND PIPING
- FENCE
- ▨ STORAGE TANKS
- ▤ PAVED AREA

- ⊕ HAND AUGER SAMPLE LOCATION
- ⊕ TEST PIT LOCATION
- ⊕ EPRS EXPLORATORY TEST PITS
- ⊕ WEHMAN ENGINEERING MONITOR WELL INSTALLED 1980. (MW-1 TO MW-8)
- ⊕ GROUNDWATER TECHNOLOGY MONITOR WELL INSTALLED 1983 (MW-6 TO MW-10)
- ⊕ GEOENGINEERING MONITOR WELL INSTALLED 1989 (MW-11 TO MW-18)
- ⊕ ADDITIONAL WELL OR CAISSON SUMP LOCATION



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ADDITIONAL RECOVERY POINTS

FIGURE	DATE	REVISION
3-1	1/18/91	0

capability to be easily converted to active recovery if necessary and its oleophilic membrane which is capable of collecting product down to a sheen.

The skimmers best suited for the additional recovery wells near MW-2 and MW-3 would be large diameter SOS units similar to those used in existing system. The expansion of the SOS system to these two additional wells would require the addition of a third product recovery pump and of buried product lines to the new wells. The additional product pump would necessitate the relocation of all the product pumps from the interior to the exterior of the SOS system shed because of space constraints. The additional buried product line offers the benefit of a common product collection location (outside the SOS shed) and the disadvantage of an additional obstruction to future site excavation work.

The additional recovery wells would be constructed according to standard NJDEP specifications as illustrated in Figure 3-2. The decision to use a 6-inch well diameter rather than the 4-inch diameter used for the existing recovery wells was based on the relative merits of commercially available skimming equipment. The larger equipment offers greater potential groundwater pumping capacity (25 gallons per minute) for future active recovery and in the case of the additional well near MW-1, greater water-exclusion reliability.

Assuming the maximum recovery rate for the three wells proposed in this alternative is approximately the same as the MW-11s, the estimated initial recovery rate for this alternative along is 2-4 gallons per day. However, because these wells are located closer to the outer boundary of the immiscible product layer, their actual recovery rate would probably be less.

One disadvantage of recovery wells is that drilling conditions at the site are very difficult due to presence of boulders in the shallow subsurface. This makes the installation of wells more difficult than the installation of shallow caisson sumps.

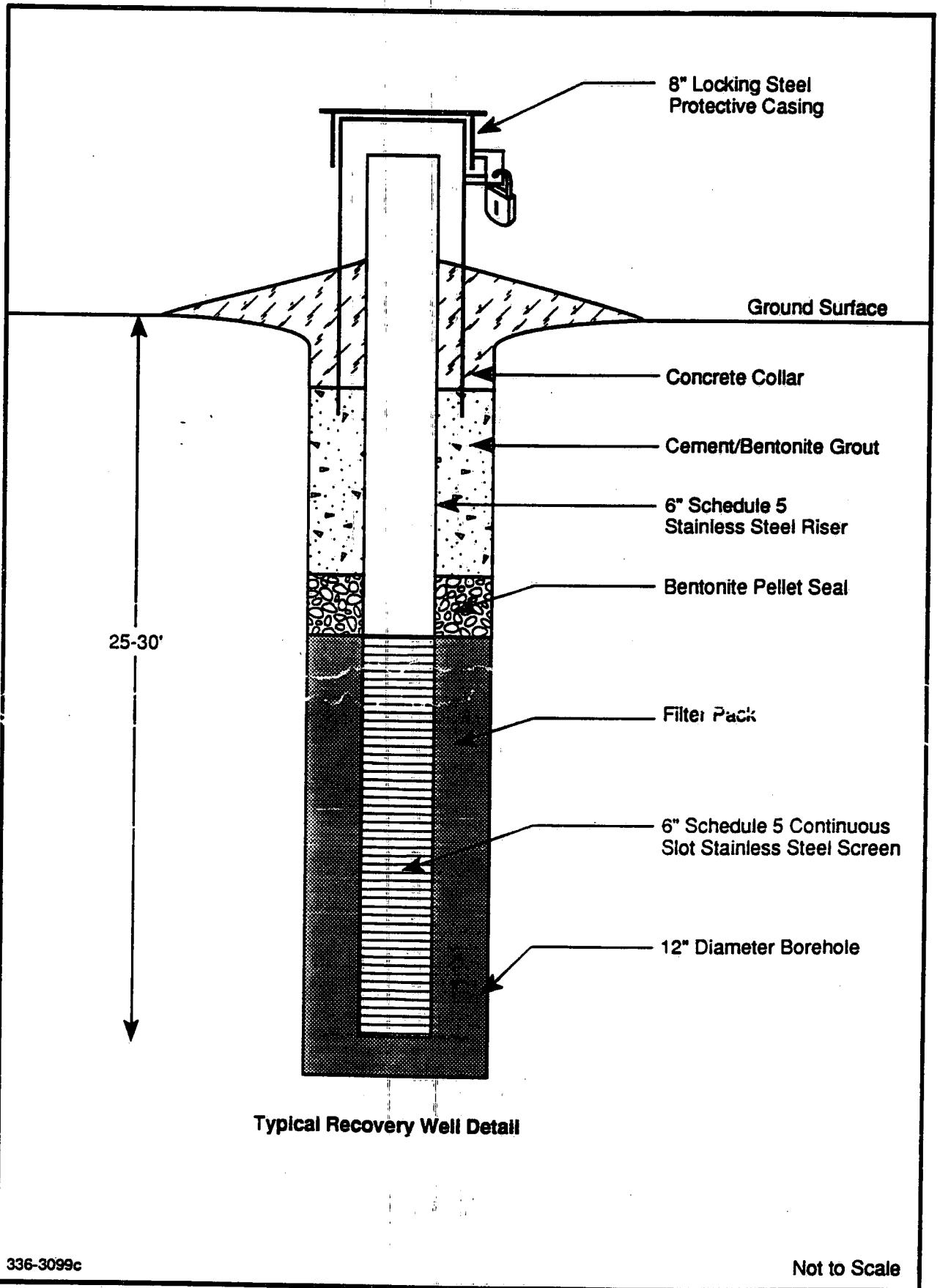


FIGURE 3-2 ADDITIONAL RECOVERY WELL ALTERNATIVE: CONSTRUCTION DETAIL

3.3 CAISSON SUMP ALTERNATIVE

This alternative, which is subsequently divided into four separate incremental options, is fundamentally similar to the Additional Recovery Well Alternative discussed previously in Subsection 3.2. A caisson sump, shown in Figure 3-3, is essentially a large (36-inch) diameter recovery well. Because of the similarity of these two alternatives, the layout for the caisson sump alternative is the same as the additional well layout shown in Figure 3-1.

The caisson sumps have the following advantages:

- The larger diameter results in a greater influx of immiscible product. The effect of sump diameter product influx, which is not a direct proportion, is more pronounced for passive recovery points than for active ones.
- Larger storage volume makes manual (i.e., weekly vs. continuous) operation a viable option. However, the recovery rate for a continuous system would be greater than that of a manual system because the continuous system maintains the maximum gradient.
- Because of the boulders encountered in the subsurface and the high water table at the site, shallow caisson sumps can be installed, using a backhoe, more easily than recovery wells, which require a drill rig.
- Their simplicity and ease of installation allow caisson sumps to be installed flexibly and incrementally as immiscible product conditions change during the remediation.
- A greater selection of skimmers is commercially available for sumps than for recovery wells.

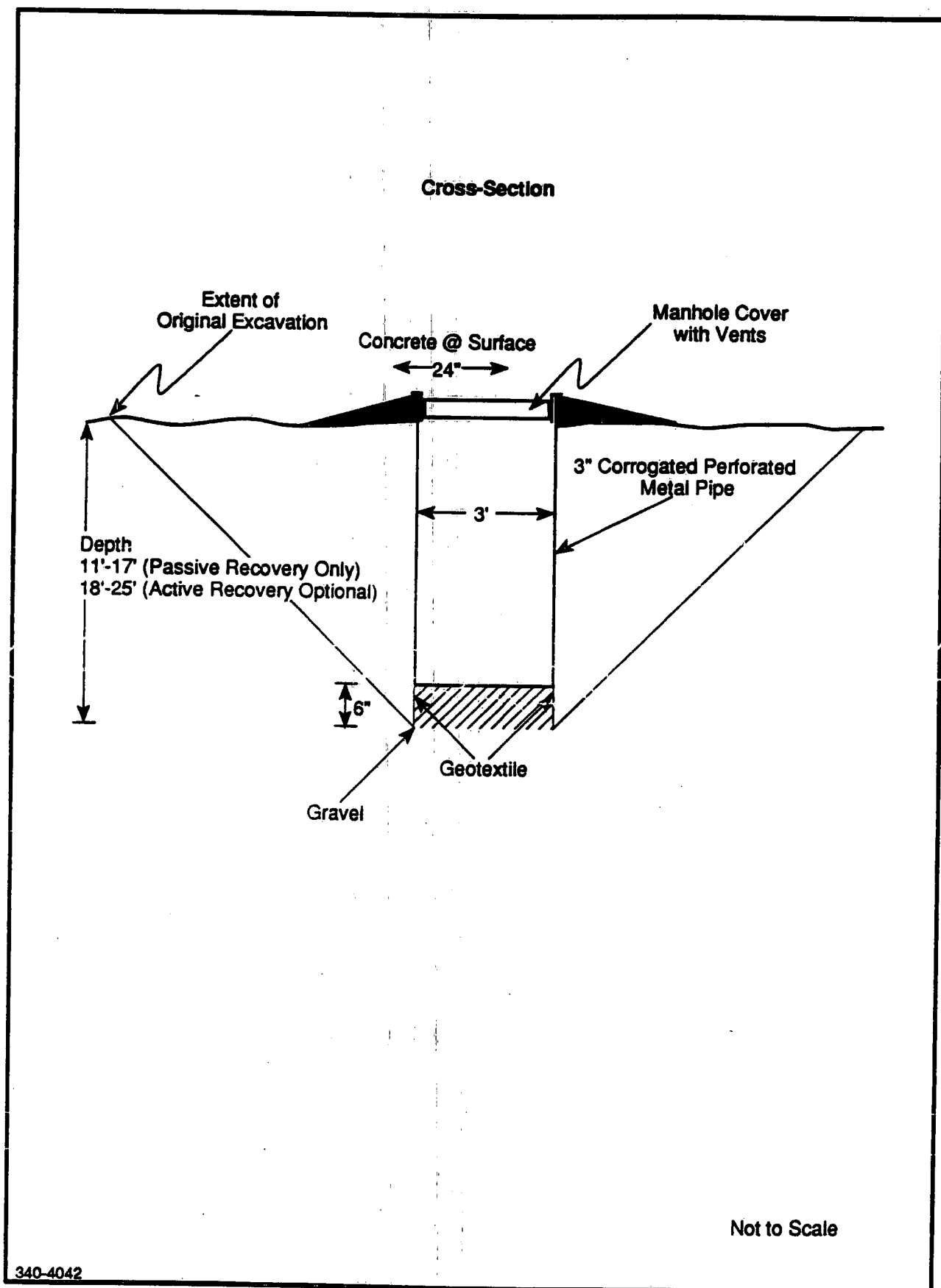


FIGURE 3-3 CAISSON SUMP ALTERNATIVE: CONSTRUCTION DETAIL

The caisson sumps have the following disadvantages:

- Caisson sumps are less adaptable to active recovery because of the difficulty of installing the sumps to the depth necessary for groundwater extraction.
- The excavation of sumps using a backhoe would require a large area (to maintain safe sloping during installation) and would expose a large area of the immiscible product layer which may generate emissions of volatile organic compounds.

Within the caisson sump alternative, two options have been developed: deep caisson sumps (20 to 25 feet in depth) and shallow caisson sumps (10 to 15 feet in depth).

The difference between the options distinguished based on their convertability to future active recovery is the depth of the sump. Caisson sumps are adaptable to groundwater depression only if they have been constructed to a depth of 10 feet greater than the minimum depth required for a similarly located passive recovery sump. The incremental depth is necessary to allow for drawdown of the water table, a phase separation interval, and an adequately sized sediment sump.

Because of the boulders encountered in the subsurface at the site, the preferred method of sump excavation would be a backhoe rather than an auger. At depths greater than approximately 15 feet, the cost of installing caisson sumps increase dramatically because of the large equipment and mobilization costs required.

Also, at these greater depths the areal extent of the excavation can grow to as large as 55 feet in diameter. For passive recovery the performance of deep and shallow caisson sumps would be identical. However, the significantly greater recovery rates attainable via active recovery would not be a future option for shallow recovery sumps. Shallow recovery sumps are an attractive options in situations where a short-term focused, flexible, inexpensive alternative is desired.

The performance of a continuous caisson sump alternative would be the same as or slightly greater than the additional recovery well alternative, 2-4 gallons per day.

3.4 RECOVERY TRENCH ALTERNATIVE

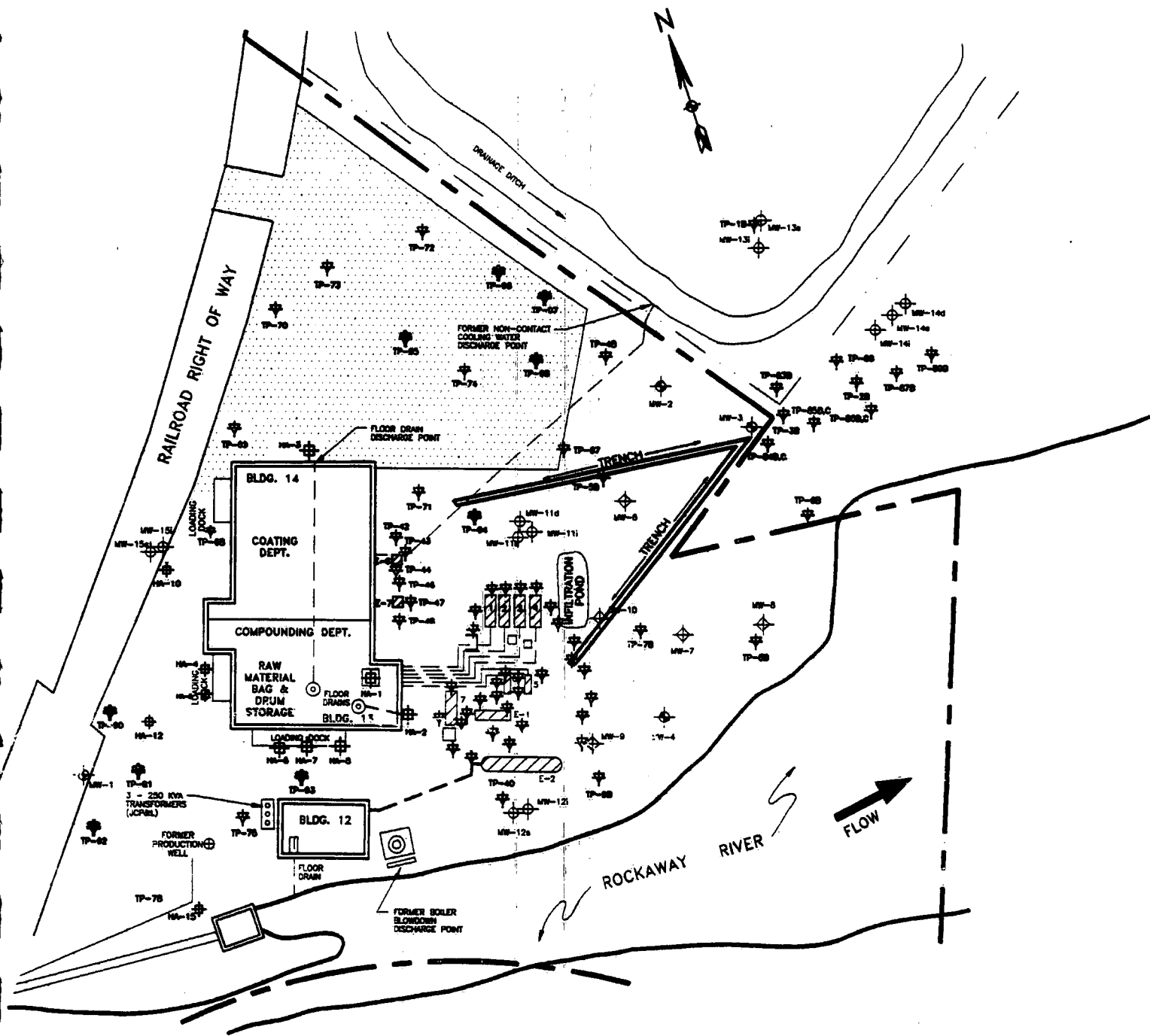
A trench system is an alternative to enhance immiscible product recovery at the Carpenter facility. Figure 3-4 shows one possible layout for such a trench and Figure 3-5 shows basic construction details. The trench system would consist of two "legs" of 6-inch perforated or slotted pipe laid horizontally in a trench filled with crushed stone. The two legs would meet at a central collection sump consisting of a 20-foot vertical section of perforated 36-inch pipe. Immiscible product would drain from the surrounding soil into the trench and be conveyed by the pipe to the sump where it would be pumped-off by a skimmer.

The trench system has the following advantages:

- A trench system could provide a more effective barrier to further migration of immiscible product upgradient of the trenches toward site boundaries.
- Immiscible product recovery equipment is required at only one point so operations and maintenance are simplified.
- A trench system could be used to recover groundwater as part of the final site remediation. Groundwater pumping would also increase the rate of immiscible product recovery by creating a depressed water table in the vicinity of the trench.

The trench system has the following disadvantages:

- A trench system would take several months to design and implement.
- A trench system would be difficult to troubleshoot or modify.



LEGEND

- PROPERTY LINE
- - - UNDERGROUND PIPING
- - - FENCE
- ▨ STORAGE TANKS
- PAVED AREA

- ⊕ HAND AUGER SAMPLE LOCATION
- ⊕ TEST PIT LOCATION
- ⊕ EPRS EXPLORATORY TEST PITS
- ⊕ WEHRAN ENGINEERING MONITOR WELL INSTALLED 1980. (MW-1 TO MW-5)
- ⊕ GROUNDWATER TECHNOLOGY MONITOR WELL INSTALLED 1983 (MW-6 TO MW-10)
- ⊕ GEOTECHNICAL MONITOR WELL INSTALLED 1989 (MW-11 TO MW-18)



L.E. CARPENTER AND CO.
WHARTON, NEW JERSEY

**RECOVERY TRENCH ALTERNATIVE:
LAYOUT**

FIGURE	DATE	REVISION
3-4	1/18/91	0

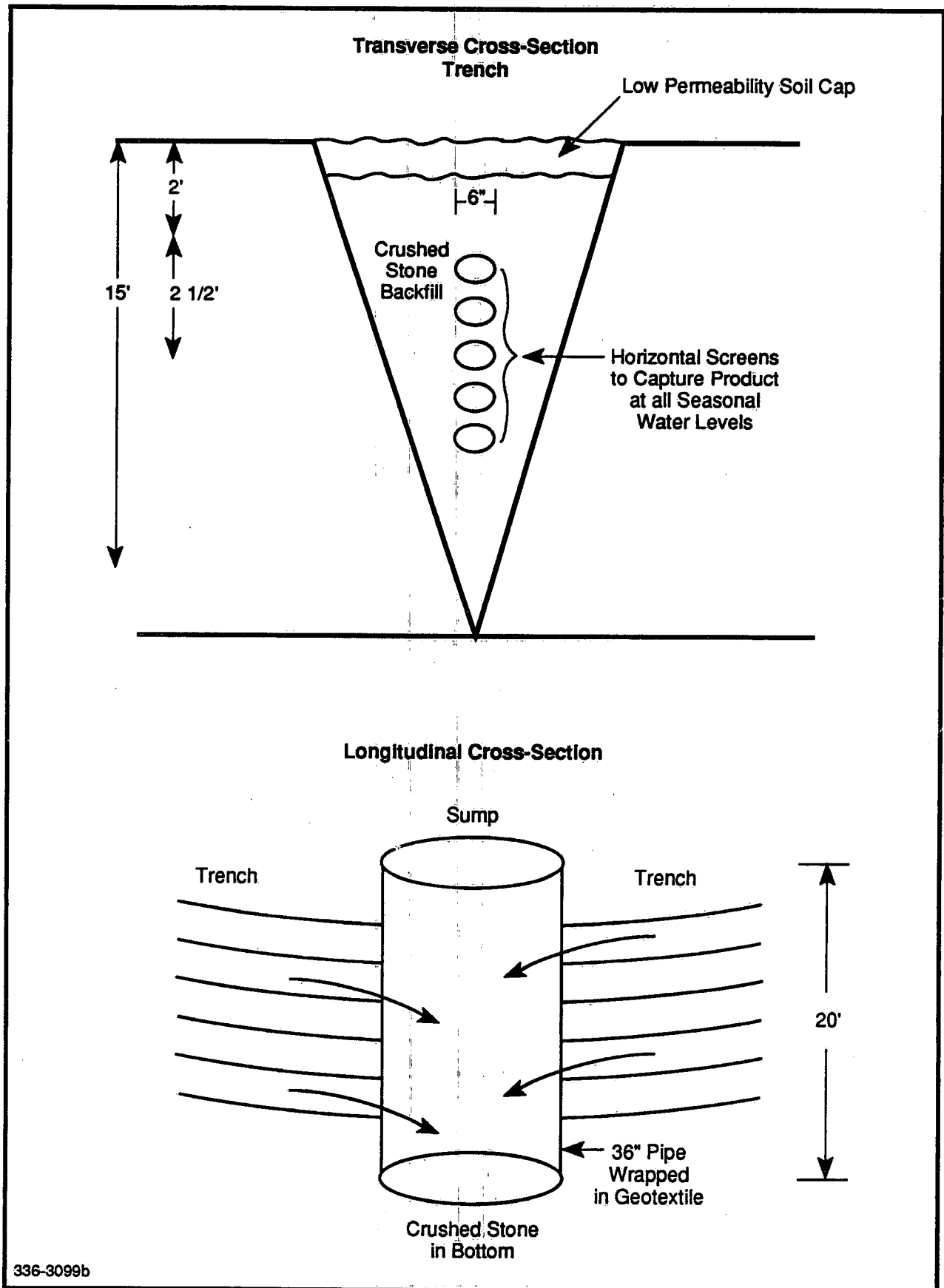


FIGURE 3-5 RECOVERY TRENCH ALTERNATIVE: CONSTRUCTION DETAIL

- Excavation of the trench would generate significant volumes of contaminated soil and boulders requiring disposal.
- Since groundwater recovery from the trench is not planned at this time, recovery of immiscible product would depend on the natural gradient of the water table and that induced by immiscible product recovery.
- Of the EIPRS alternatives considered, trenches are the most complex, risky, and expensive to design. Because of the effort and expense required to implement this alternative, serious consideration would have to be given to the long-term utilization of the system. Any conversion of the trench system to groundwater recovery as part of the final site remediation would depend on the outcome of the FS. It is possible that during the FS process, this trench alternative, which is focused on immiscible product recovery, will be found unsuitable for immiscible product containment and groundwater recovery.
- A trench system if improperly designed could result in accelerated migration of uncontained immiscible product toward site boundaries.

3.5 ALTERNATIVES SCREENING AND RECOMMENDATIONS

The characteristics of the four EIPRS each alternatives are summarized in Table 3-1. Screening and recommendations for each are presented below.

3.5.1 Improvements to the Existing System

Improvements to the existing recovery system would include new skimmers which would operate over a much larger vertical range and have a larger pumping capacity. The improvements would be expected to double or triple product recovery in the three wells. Costs are lower for this alternative than the other alternatives.

TABLE 3-1

L.E. CARPENTER
EIPRS - SCREENING OF ALTERNATIVES

Alternative	Recovery	Effectiveness	Flexibility	Implementability (Design, Installation, Risks)	Approximate Capital Cost
Improvements to Existing System	Low	Limited recovery rate. Potential to triple removal rate of existing equipment.	Low. Product yield from existing wells will decrease over time without removing much of the recoverable immiscible product between and beyond the wells. Existing wells may be adaptable to possible future active recovery.	Excellent. Modifications easily implementable.	\$7,000
Additional Recovery Wells	Good	New wells would be constructed and placed for optimal recovery, based on experience with existing recovery wells.	Good. New wells could be constructed and located to be adaptable to possible future groundwater depression. Recovery wells are flexible over the vertical extent of the immiscible product but relatively inflexible over the areal extent.	Good. Site hydrology understood. Boulder fill material makes drilling unpredictable. Low soil disposal quantity. Risk of poor location.	\$52,000
Caisson Sumps	Good	Sumps would be located at areas with thickest immiscible product. Periodic frequency less optimal than continuous recovery.	Good. Sumps can be located, augmented, and operated flexibly. However, sumps adaptable to future active recovery are more expensive.	Good. Sumps would be simple and inexpensive to design and install. Moderate soil disposal quantity.	Option A - \$62,000 (Active/Continuous) Option B - \$39,000 (Passive/Continuous)
Recovery Trench	Good	Design typically based on long-term utilization with active recovery, so product yields with passive recovery may be low. A trench located to provide product containment would not be ideally located for product recovery.	Low. Trench location and design could incorporate some vertical and areal collection flexibility. Trench modifications possible with difficulty. Trenches may be adaptable to possible future remedial technologies.	Difficult. Most complex, risky, and expensive alternative to design. Need to consider long-term utilization possibilities. Maximizing containment qualities increases the risk of low initial product yields. Risk of accelerating off-site migration of contaminants. Large soil disposal quantity.	\$95,000

3.5.2 Additional Recovery Wells

The addition of three product recovery wells would be expected to improve product recovery two to four times over existing recovery rates. The wells would be larger diameter (6 inches) than the existing recovery wells and would be placed in areas of the product layer that the current recovery system does not impact (two further downgradient and one near MW-1). Two wells would be connected to the existing collection system, and the well near MW-1 would have an independent automatic pumping and collection system, which would require an electrical hookup. The wells could be adapted to active recovery via groundwater depression, as well as converted to groundwater extraction wells when the product has been removed. Well and recovery system installation would cost approximately \$52,000, excluding disposal of soil cuttings.

3.5.3 Caisson Sumps

Caisson sumps would be located in the same locations as the proposed recovery wells. The sumps could either be designed as passive only or convertible to active recovery, and as continual pumping or manually-activated weekly pumping. Manually-activated collection would be the least expensive option, even when operation and maintenance costs are considered. However, collection rates are likely to be lower than with continuous pumping. A continual-collection, passive-only system would cost about \$13,000 less than the recovery well option, while the same system convertible to active recovery would cost approximately \$10,000 more than recovery wells, not including soil disposal costs, which could be substantial with the deeper convertible sumps. Recovery rates of the sumps would be comparable to that of the wells. Sump excavation would produce approximately 4 cubic yards of soil requiring disposal per sump and possible air emissions of volatile organic compounds.

3.5.4 Recovery Trench

A recovery trench would be most effective at containing the product downgradient of the existing system. A trench located downgradient of the product would improve containment but would not maximize recovery, since it would be located in an area containing less product. Recovery rates are less predictable, but long-term rates would probably increase two to four times over the existing system. A recovery trench is approximately twice as expensive as installing wells or sumps, with no additional recovery rate improvements and greater risk of poor system performance. Of the four alternatives considered, trench excavation would generate the greatest quantity of volatile emissions and soil to be disposed of.

3.5.5 Recommendation

Based on its cost effectiveness, the alternative to improve the existing recovery system will be implemented.

As a additional step to control product migration, the remaining alternatives were further evaluated for implementation. The recovery trench alternative is screened out due to its generation of large soil volumes and higher cost with no recovery advantage expected over sumps or wells.

Recovery systems which are convertible to active recovery, which may be implemented when full-scale groundwater remediation is begun, are preferable to passive-only systems. Although passive-only systems are less expensive to install, the savings are usually outweighed by the added expense of installing new active collection points later. Therefore, passive-only sumps will be screened out.

Recovery wells are preferred over sumps because they are easily converted for active product recovery and/or groundwater extraction, require less soil excavation, and are slightly

less expensive than convertible sumps. Therefore, recovery wells, in addition to improvements to the existing recovery system, are recommended to enhance product recovery at the site.

SECTION 4

IMPLEMENTATION

4.1 DESIGN AND OPERATION

The general design of the improvements to the existing recovery system, and the installation and hookup of additional recovery wells, were presented in Subsections 3.1 and 3.2. Additional details concerning their design and operation are presented below.

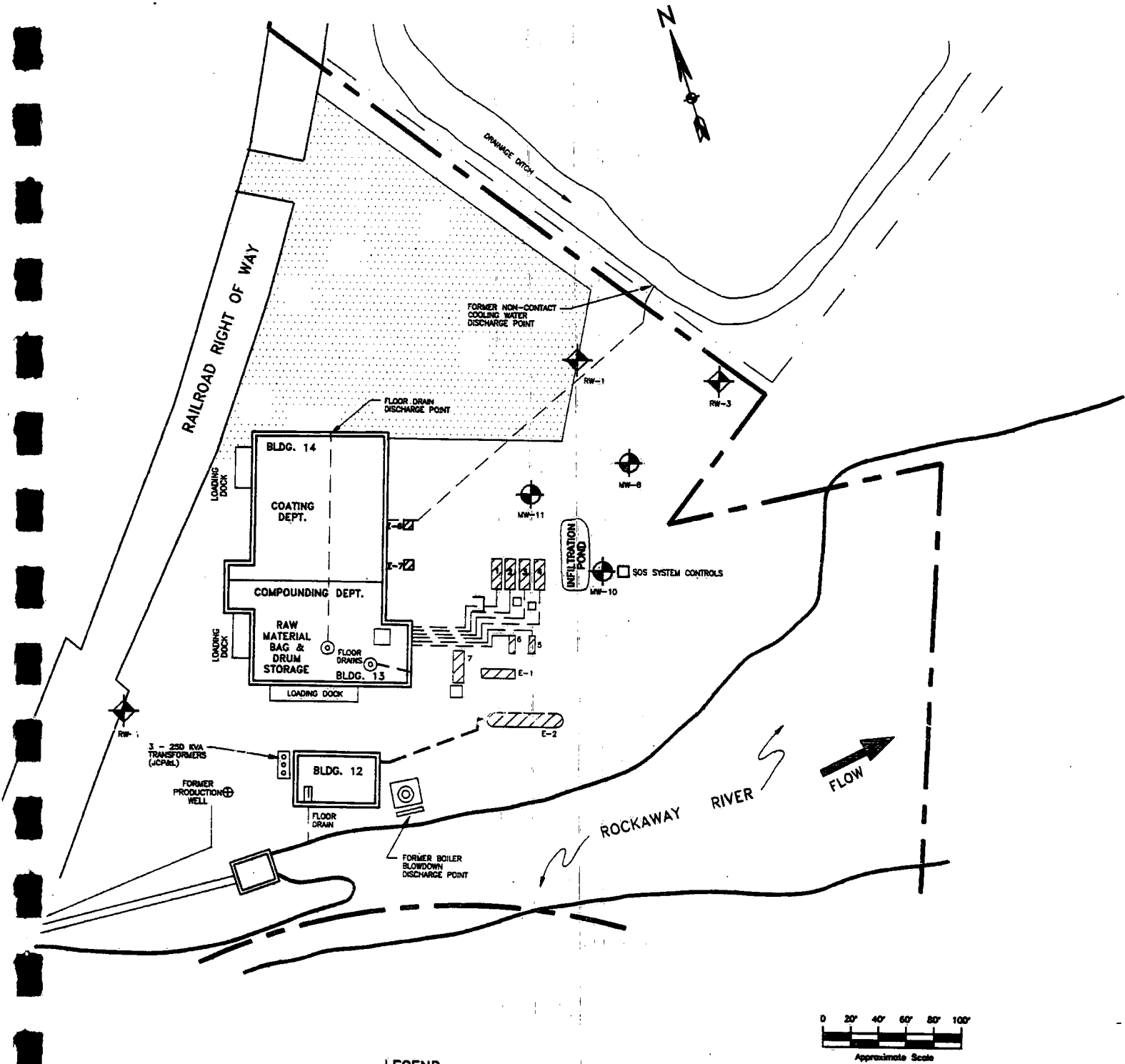
4.1.1 Improvements to the Existing Recovery System

Equipment to be installed will consist of three new skimmer assemblies. After the new skimmer assemblies have been received, the existing skimmers will be removed from the three wells and replaced by the new down-well assemblies. The midpoint of the skimmer range will be positioned at the average groundwater elevation so as to optimize product collection.

The system is designed to be operated and maintained the same as previously. Since product recovery rates will be enhanced, the collection drums will need to be checked and removed more frequently.

4.1.2 Additional Recovery Wells

Three 6-inch diameter recovery wells are to be installed at the locations shown in Figure 4-1. The construction detail is presented in Figure 3-3. Wells will be installed in accordance with NJDEP guidelines, and well permits will be obtained from the Department. The drilling method will be air rotary.



LEGEND

- | | | | |
|--|--------------------|--|--------------------------|
| | PROPERTY LINE | | EXISTING RECOVERY WELL |
| | UNDERGROUND PIPING | | ADDITIONAL RECOVERY WELL |
| | FENCE | | |
| | STORAGE TANKS | | |
| | PAVED AREA | | |



L.E. CARPENTER AND CO. WHARTON, NEW JERSEY		
EIPRS RECOMMENDED ALTERNATIVE		
FIGURE 4-1	DATE 1/18/91	REVISION 0

Each well will be installed to a depth that would allow at least 5 feet of drawdown. Allowing for an additional bottom well clearance of 5.5 feet and a skimmer height of 8 feet, each well will be drilled at least 18.5 feet below the lowest observed water table depth. These criteria will result in the following approximate well depths:

- o RW-1 (adjacent to MW-1) to 30 feet
- o RW-2 (west of MW-2) to 25 feet
- o RW-3 (adjacent to MW-3) to 25 feet

During drilling, levels of volatile organic compounds will be monitored for health and safety purposed using an HNu or organic vapor analyzer. Health and safety protocols presented in the Supplemental RI Sampling Plan will be followed. After installation, the drilling equipment will be decontaminated before being removed from the site.

Immediately following their installation, the wells will be developed by backwashing with air. Development improves the recovery rate of the well by increasing the permeability at the well screen. The three existing recovery wells MW-6, MW-10, and MW-11s will also be developed at this time. Groundwater generated by development activities will be drummed for later disposal.

RW-2 and RW-3 will be connected to the SOS system used for the existing recovery wells. An additional centralized pump will be added to the system to accommodate the two new recovery wells. Trenches will be excavated between the new wells and the pump shed, and a 0.25-inch steel-sheathed hydraulic hose housed within a 3-inch PVC pipe will be installed to connect the wells to the new pump.

An individual recovery system will be located in the RW-1. An ORS skimmer system will be installed in RW-1, which will enable continual recovery. The product will be collected

in a drum located adjacent to the well. When full, the drum will be moved to the current drum storage area for subsequent removal.

4.2 SCHEDULE

The schedule for implementation of the EIPRS is provided in Figure 4-2.

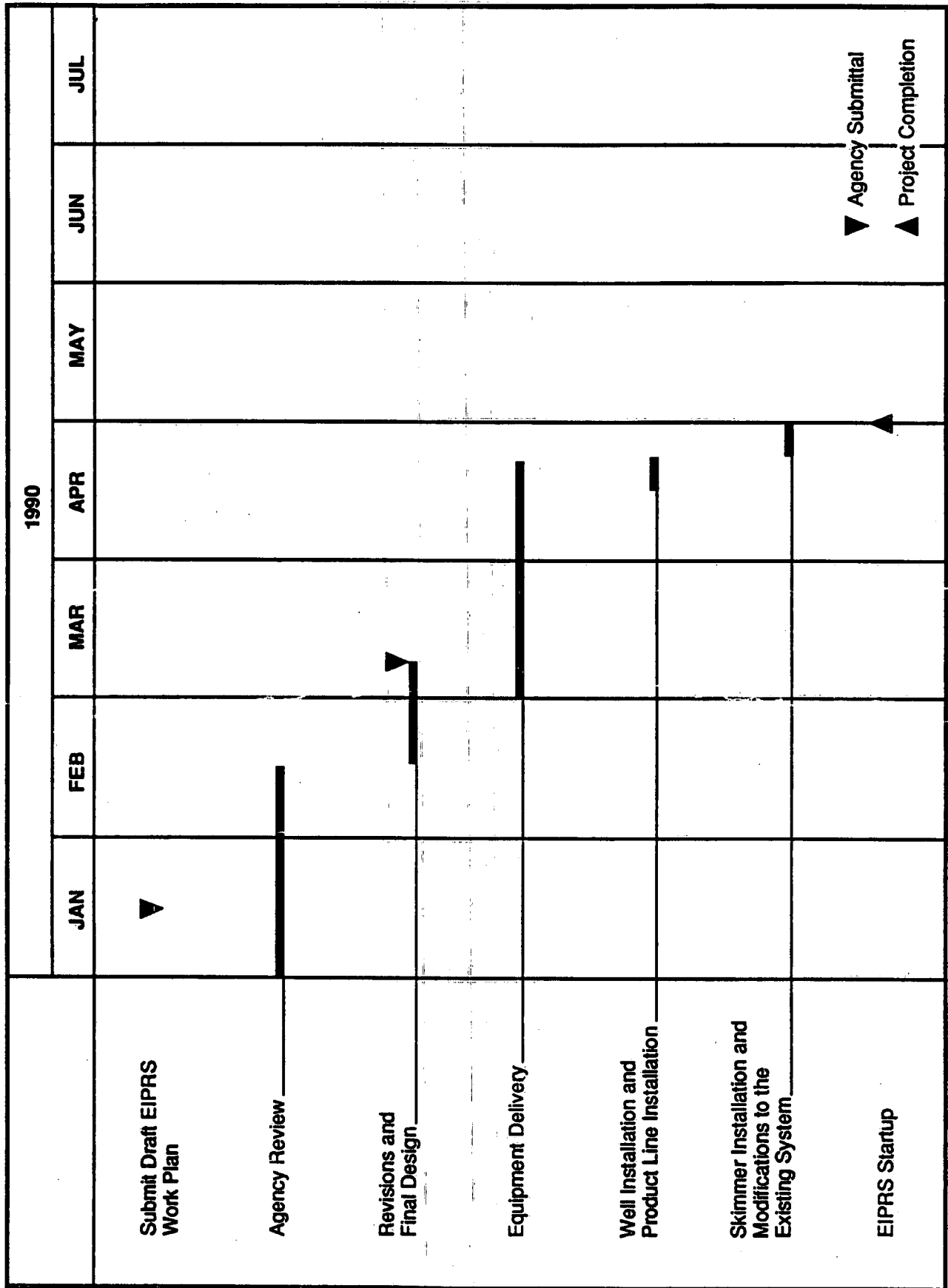


FIGURE 4-2 EIPRS IMPLEMENTATION SCHEDULE

APPENDIX A

IMMISCIBLE PRODUCT ANALYSES



ROY F. WESTON, INC.
Lionville Laboratory

CLIENT : WSI-L.E. CARPENTER
RFW# : 9012L066, GC SCAN
W.O.# : 3600-04-54-0003

NARRATIVE

This sample set consisted of one oil collected on December 18, 1990.

The sample was analyzed by GC/FID on January 3, 1990 and compared with standards of common hydrocarbon products (fuels and oils). A standard of di(2-ethylhexyl)phthalate was also analyzed as this was a suspected component in the mixture.

The sample and standards were prepared in dichloromethane and analyzed using the G.C. conditions given below.

1. Chromatographic Conditions

A 30 meter, 0.53 mm ID SPB5 capillary column with temperature programming and FID detection was used for this analysis. Helium was used as carrier gas at a flow rate of 20 ml/minute. The temperature program started at 45 deg. C with an initial hold time of 3 minutes. The temperature was increased at 8 deg. per minute to 300 deg.C with a final hold time of 16 minutes. Sample injection volume was five microliters.

for J. Michael Taylor
Project Director
Lionville Analytical Laboratory

1/17/91
Date

9012L066

Roy F. Weston, Inc.- Lionville Laboratory

Hydrocarbon Fingerprinting

Client :WSI L.E. Carpenter
RFW# :9012L066-001
Client ID :FP-115-B
Matrix :Oil

Sample Collected:12/18/90
Sample Received :12/26/90
Sample Prepared :12/28/90
Sample Analyzed :01/03/91

Qualitative Identification

Sample appears to be a mixture of three major components:

- (a) Product in the C8-C12 region with a fingerprint similar to gasoline.
- (b) One compound in the C25-C26 region with a retention time the same as that of Di(2-ethylhexyl) phthalate.
- (c) Product in the C26-C32 region with a fingerprint indicative of a motor oil or other lubricating oil.

Quantitative Report (results are semi-quantitative only)

- (a) C8-C12 (gasoline) = 220 g/l
- (b) C25-C26 (Di(2-ethylhexyl) phthalate) = 260 g/l
- (c) C26-C32 (motor oil) = 140 g/l

Sample quantified versus : Diesel

90122L 066

WESTON
MANUFACTURING DESIGNERS/ENGINEERS/ARCHITECTS

WSI - LE Carpenter

Work Order 3600-04-54-0083

Date Rec'd. 12/26/90 Date Due 1/9/91

RFW Contact Mike Heiney x3753/Mike Young

Client Contact/Phone

WSI-LECARP

[illegible]

Matrix:	W - Water	DS - Drum Solids	X - Other
S - Soil	O - Oil	DL - Drum Liquids	
SE - Sediment	A - Air	F - Fish	
SO - Solid	WI - Wipe	L - EP/TCLP Leachate	

Special Instructions: Run GC fingerprint analysis & compare to xylene standard. Second vial for breakage or reanalysis. Two-week turnaround.

[illegible]

WESTON Analytics
Use Only

Samples Were...
1 Shipped or Hand-Delivered ☒ **NOTES:**

2 Ambient or Chilled ☒ **NOTES:**

3 Received Broken/
Leaking (Improperly
Sealed) ☒ **NOTES:**

4 Properly Preserved ☒ **NOTES:**

5 Received Within
Holding Times ☒ **NOTES:**

COC Tape Was:

1 Present on Outer
Package ☒ **NOTES:**

2 Unbroken on Outer
Package ☒ **NOTES:**

3 Present on Sample ☒ **NOTES:**

4 Unbroken on Sample ☒ **NOTES:**

COC Record Was:

1 Present Upon Receipt
of Samples ☒ **NOTES:**

Discrepancies Between
Sample Labels and COC
Record? ☒ **NOTES:**



ROY F. WESTON, INC.
Lionville Laboratory

CLIENT : WSI-L.E. CARPENTER
RFW# : 9101L167, GC SCAN (C6 - C12 REGION ONLY)
W.O.# : 3600-04-54-0003

NARRATIVE

This sample set consisted of one oil collected on December 18, 1990.

The sample was analyzed by GC/FID on January 11 & 12, 1990 and compared with standards of xylenes, other aromatic compounds and naphtha.

This sample had been analyzed previously (RFW # 9012L066) and had given a fingerprint which was similar to gasoline. Under the analytical conditions used previously, any naphtha present in the sample would have been masked by the solvent used, so the sample and standards were prepared in carbon disulfide.

Because gasoline contains a very high percentage of xylenes and other aromatic compounds, the analytical conditions were modified to give better resolution of individual hydrocarbons so that more positive identification of components could be achieved. These conditions are given below.

1. Chromatographic Conditions

A 30 meter, 0.53 mm ID SPB5 capillary column with temperature programming and FID detection was used for this analysis. Helium was used as carrier gas at a flow rate of 20 ml/minute. The temperature program started at 33 deg. C with an initial hold time of 7 minutes. The temperature was increased at 3 deg. per minute to 140 deg.C. The temperature was elevated rapidly to 300 deg. C at the end of each run to remove late eluting peaks from the column.

Sample injection volume was one microliter.

for J. Michael Taylor
Project Director
Lionville Analytical Laboratory

1/17/91
Date

9101L167

Roy F. Weston, Inc.- Lionville Laboratory

Hydrocarbon Fingerprinting

Client	:WSI L.E. Carpenter	Sample Collected:12/18/90
RFW#	:9101L167-001	Sample Received :01/10/91
Client ID	:FP-115-B	Sample Prepared :01/11/91
Matrix	:Oil	Sample Analyzed :01/11-12/91

Qualitative Identification (C6-C12 Region)

The major peaks in this region were identified as ethyl benzene and xylene isomers.

Peaks in the C6-C8 region of the chromatogram provided a fairly good match with Naphtha.

Further peaks were seen in the C8-C12 region which could not be identified and were classified as unknown hydrocarbons.

Quantitative Report (results are semi-quantitative only)

Total Xylenes	= 160 g/l	(a)
Ethylbenzene	= 40 g/l	(a)
Naphtha	= 20 g/l	(b)
Unknown HC's	= 40 g/l	(a)

Sample quantified versus : (a) Xylene (b) Naphtha

WESTON Analytics Use Only

910/L/67

Custody Transfer Record/Lab Work Request

WESTON

Client WSI - Le Carpenter
Work Order 3600-04-54-0003
Date Rec'd. 1/16/91 Date Due 1/17/91
RFW Contact Relay mine Young
Client Contact/Phone _____

Refrigerator#	1	1							
#/Type Container	1/6	1/6							
Volume	40ml	40ml							
Preservative	—	—							
ANALYSES REQUESTED	GC/MS	GC/MS							
Matrix	Date Collected	GC/MS	GC/MS						
Oil	12/15/00	X	X					9012 L066-001	
ethyl hexyle phthalate									
red to GULF Coast									
b 1375									
the xylene									

WESTON Analytics
Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/
Leaking (Improperly
Sealed)

NOTES:

4 Properly Preserved

NOTES

5 Received Within
Holding Times

NOTES:

COC Tape Was:

1 Present on Outer Package

2 Unbroken on Outer
Package Y

3 Present on Sample

4 Unbroken on Sample
NOTES: Y

COC Record Was:

1 Present Upon Receipt
of Samples

Discrepancies Between
Sample Labels and CDC
Record? Y ☒ N ☐

NOTES:

Matrix: W - Water DS - Drum Solids X - Other
S - Soil O - Oil DL - Drum Liquids
SE - Sediment A - Air F - Fish
SO - Solid WI - Wipe L - EP/TCLP Leachate

Special Instructions:

$$Q_c / R_{el} = CLP$$

7 Day Turn

[illegible]

Roy F. Weston, Inc. - Gulf Coast Laboratories
BNA ANALYTICAL DATA PACKAGE FOR
WSI-Le Carpenter

DATE RECEIVED: 01/11/91

RFW LOT # :9101L167

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
FP-11S-B	001		OI 91GB0020	12/18/90	01/15/91	01/16/91
FP-11S-B	001	01	OI 91GB0020	12/18/90	01/15/91	01/16/91

LAB QC:

SBLK	MB1		OI 91GB0020	N/A	01/15/91	01/15/91
------	-----	--	-------------	-----	----------	----------

SIGNATURE _____ DATE _____

RFW Batch Number: 9101L167

Client: WSI-Le Carpenter

Work Order: 3600-04-54-0003

Page: 1a

Cust ID:		FP-11S-B	FP-11S-B	SBLK
Sample Information	RFW#:	001	001 DL	91GB0020-MB1
	Matrix:	OIL	OIL	OIL
	D.F.:	100	2500	1.00
	Units:	ug/Kg	ug/Kg	ug/Kg
Surrogate Recovery	Nitrobenzene-d5	NA %	NA %	NA %
	2-Fluorobiphenyl	NA %	NA %	NA %
	Terphenyl-d14	NA %	NA %	NA %
=====f1=====f1=====f1=====f1=====f1=====				
bis(2-Ethylhexyl)phthalate		E	0.41E+09 ⁴⁴	330 U
			410000000	
			41%	

*- Outside of EPA CLP QC limits.

HYDROCARBON FINGERPRINTING

Modified ASTM Method D3328

Client Name: GeoEngineering, Inc.

Client ID: 19222-MW-11S

Lab ID: 4567-08

Matrix: Oil

Authorized: 22 SEP 89

Sampled: 21 SEP 89

Prepared: 02 OCT 89

Received: 22 SEP 89

Analyzed: 05 OCT 89

Parameter	Result	Units	Reporting Limit
Total Petroleum Hydrocarbon	770,000	µg/g (oil)	See below
Individual Hydrocarbon	NA	µg/g (oil)	470
Total Product	NA	µg/g (oil)	19,000
o-Terphenyl	Diluted out	%	NA

Qualitative Identification: This sample has GC/FID characteristics that are similar to a mixture of gasoline and a petroleum product in the lubricating oil range with polar components in the n-C₂₅ to n-C₂₆ range.

All results and limits are reported on a dry weight basis.

Minimum reporting limit for individual hydrocarbons = 0.25 µg/g (oil).

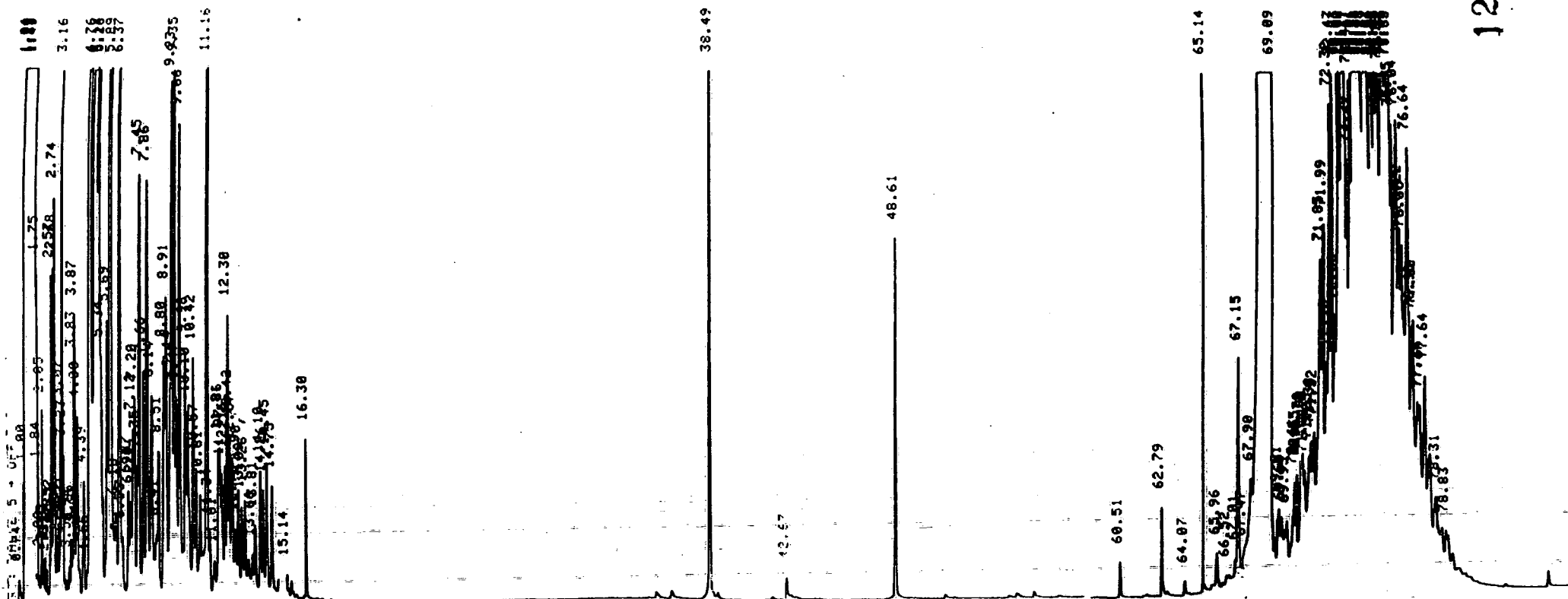
Minimum reporting limit for total products = 10.0 µg/g (oil).

N.D. = Not Detected

N.A. = Not Applicable

Reported by: Kevin McCarthy

Approved By: Robert Lizotte



HYDROCARBON FINGERPRINTING

Modified ASTM Method D3328

Client Name: GeoEngineering, Inc.

Client ID: 90023-MW-11S

Lab ID: 5462-01

Matrix: Waste

Authorized: 30 JAN 90

Sampled: 26 JAN 90

Prepared: 02 FEB 90

Received: 29 JAN 90

Analyzed: 14 FEB 90

Parameter	Result	Units	Reporting Limit
Total Petroleum Hydrocarbon	1,000,000	mg/L (oil)	See below
Individual Hydrocarbon	NA	mg/L (oil)	50.0
Total Product	NA	mg/L (oil)	2000.0
o-Terphenyl	Diluted out	%	NA

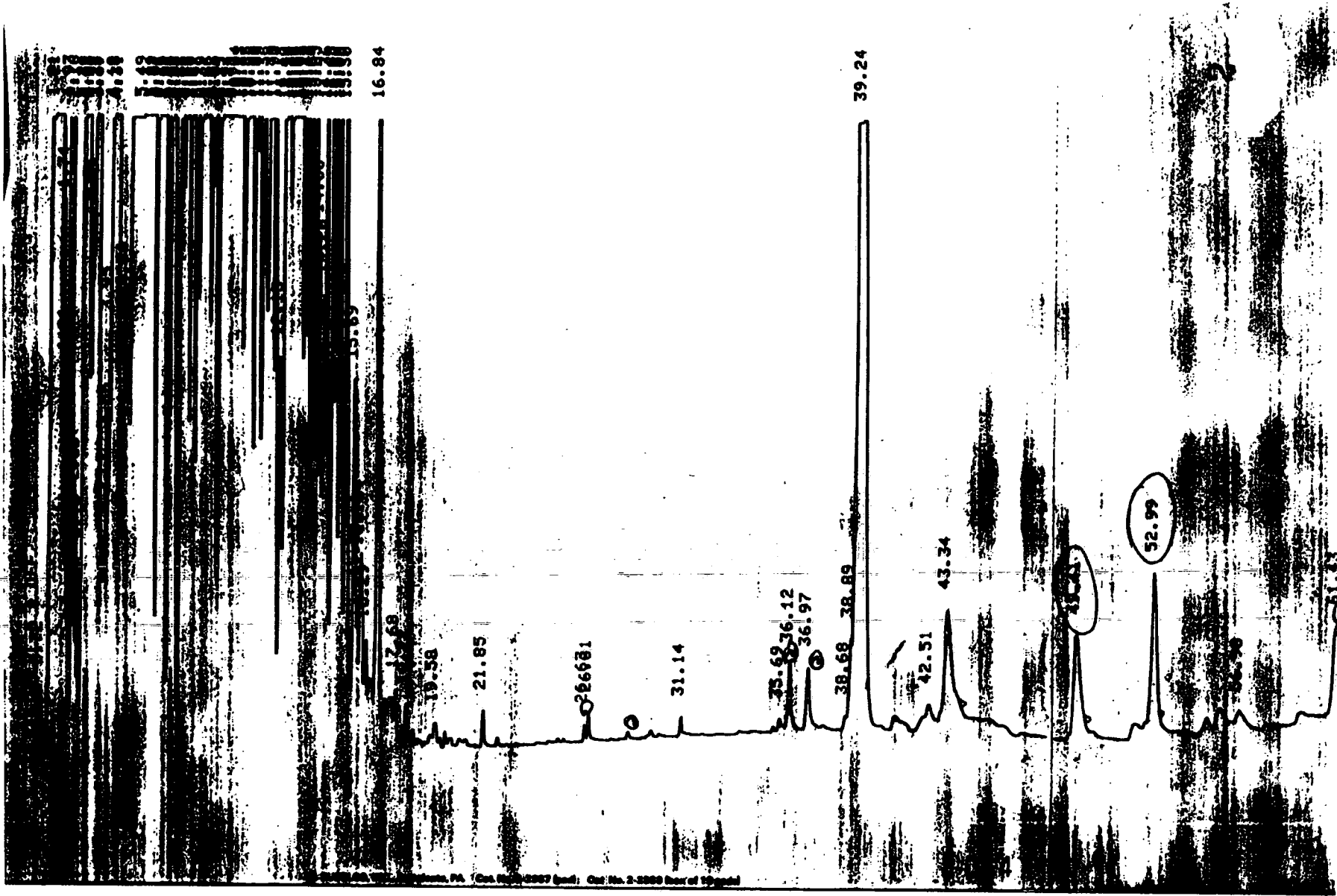
Qualitative Identification: This sample has GC/FID characteristics that are similar to a mixture of paint thinner and a petroleum product in the n-C₂₁ to n-C₂₈ range with a large polar component in the n-C₂₁ to n-C₂₃ range.

Minimum reporting limit for individual hydrocarbons = 0.01 mg/L (oil).
Minimum reporting limit for total products = 0.50 mg/L (oil).

N.D. = Not Detected
N.A. = Not Applicable

Reported by: Andrew Cram

Approved By: Robert Lizotte



100-100, 100-100, 100-100, PA (Cot. No. 2-2227 (bad), Cot. No. 2-2228 (bad of 10 good)